

## WHAT IS CLAIMED IS:

1. A bond coat for adhering a thermal barrier coating to an underlying metal substrate, the bond coat having an upper portion and which comprises:
  - (1) a bond coating material selected from the group consisting of aluminide diffusion coating materials, overlay alloy coating materials other than a beta-phase NiAl intermetallic overlay coating material, and combinations thereof; and
  - (2) a dispersion within at least the upper portion of the bond coat of particles having a particle size of about 2 microns or less and comprising a substantially insoluble bond coat strengthening compound, the amount of dispersed particles within the at least upper portion of the bond coat being sufficient to impart increased strengthening to the bond coat.
2. The bond coat of claim 1 wherein the bond coat strengthening compound is selected from the group consisting of substantially insoluble metal oxides, metal nitrides, metal carbides, and mixtures thereof.
3. The bond coat of claim 2 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, zirconium carbide, hafnium carbide, tantalum carbide, aluminum nitride, zirconium nitride, hafnium nitride, and mixtures thereof.
4. The bond coat of claim 3 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, aluminum nitride, zirconium nitride, hafnium nitride, and mixtures thereof.
5. The bond coat of claim 4 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, and mixtures thereof.
6. The bond coat of claim 3 wherein the amount of dispersed particles within the at least upper portion of the bond coat is at least about 0.1 volume percent.

7. The bond coat of claim 6 wherein the volume percent of dispersed particles is from about 0.1 to about 5.
8. The bond coat of claim 7 wherein the volume percent of dispersed particles is from about 0.5 to about 2.
9. The bond coat of claim 7 wherein the particle size is in the range of from about 1 to about 2000 nanometers.
10. The bond coat of claim 9 wherein the particle size is in the range of from about 10 to about 500 nanometers.
11. The bond coat of claim 1 wherein the aluminide diffusion coating material is selected from the group consisting of platinum aluminides and simple aluminides, and wherein overlay alloy coating material is selected from the group consisting of MCrAlX, wherein M is iron, cobalt, nickel, or alloys thereof, and wherein X is hafnium, zirconium, yttrium, tantalum, platinum, palladium, rhenium, silicon or a combination thereof.
12. The bond coat of claim 11 wherein the bond coating material is selected from the group consisting of aluminide diffusion coating materials, and combinations of aluminide diffusion coating materials and overlay coating materials.
13. A coated thermally protected article, which comprises:
  - a. a metal substrate;
  - b. a bond coat layer adjacent to and overlaying the metal substrate, the bond coat layer having an upper portion and comprising:
    - (1) a bond coating material selected from the group consisting of aluminide diffusion coating materials, overlay alloy coating materials, and combinations thereof; and
    - (2) a dispersion within at least the upper portion of the bond coat of particles having a particle size of about 2 microns or less and comprising a substantially insoluble bond coat strengthening compound, the amount of dispersed particles within the at least upper

- portion of the bond coat being sufficient to impart increased strengthening to the bond coat; and
- c. a thermal barrier coating layer adjacent to and overlâying the bond coat layer.
14. The article of claim 13 wherein the bond coat strengthening compound is selected from the group consisting of substantially insoluble metal oxides, metal nitrides, metal carbides, and mixtures thereof.
  15. The article of claim 14 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, zirconium carbide, hafnium carbide, tantalum carbide, aluminum nitride, zirconium nitride, hafnium nitride, and mixtures thereof.
  16. The article of claim 15 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, and mixtures thereof.
  17. The article of claim 16 wherein the amount of dispersed particles within the at least upper portion of the bond coat layer is at least about 0.1 volume percent.
  18. The article of claim 17 wherein the volume percent of dispersed particles is from about 0.5 to about 2.
  19. The article of claim 17 wherein the particle size is in the range from about 1 to about 2000 nanometers.
  20. The article of claim 19 wherein the particle size is in the range of from about 10 to about 500 nanometers.
  21. The article of claim 17 wherein the bond coat layer has a thickness of from about 0.5 to about 10 mils and comprises an overlay alloy coating material selected from the group consisting of MCrAlX wherein M is iron, cobalt, nickel, or alloys thereof and wherein X is hafnium, zirconium, yttrium, tantalum, platinum, palladium, rhenium, silicon or a combination thereof.

22. The article of claim 17 wherein the bond coat layer has a thickness of from about 0.5 to about 4 mils and comprises an aluminide diffusion coating material selected from the group consisting of platinum aluminides and simple aluminides.
23. The article of claim 17 which is a turbine engine component and wherein the thermal barrier coating has a thickness of from about 1 to about 100 mils.
24. The article of claim 23 which is a turbine shroud and wherein the thermal barrier coating layer has a thickness of from about 15 to about 30 mils.
25. The article of claim 23 which is a turbine airfoil and wherein the thermal barrier coating layer has a thickness of from about 3 to about 10 mils.
26. A coated thermally protected article, which comprises:
  - a. a metal substrate;
  - b. a bond coat layer adjacent to and overlaying the metal substrate, the bond coat layer having an upper portion and comprising:
    - (1) a bond coating material selected from the group consisting of aluminide diffusion coating materials, and combinations of aluminide diffusion coating materials and overlay alloy coating materials; and
    - (2) a dispersion within at least the upper portion of the bond coat layer of particles having a particle size of about 2 microns or less and comprising a substantially insoluble bond coat strengthening compound selected from the group consisting of substantially insoluble metal oxides, metal nitrides, metal carbides, and mixtures thereof, the amount of dispersed particles within the at least upper portion of the bond coat layer being sufficient to provide a volume percent of dispersed particles of at least about 0.1; and
  - c. a thermal barrier coating layer adjacent to and overlaying the bond coat layer.
27. The article of claim 26 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, zirconium carbide, hafnium carbide, tantalum carbide, aluminum nitride, zirconium

nitride, hafnium nitride, and mixtures thereof.

28. The article of claim 27 wherein the bond coat strengthening compound is selected from the group consisting of zirconia, hafnia, chromia, yttria, ceria, alumina, lanthana, and mixtures thereof.
29. The article of claim 28 wherein the volume percent of dispersed particles is from about 0.1 to about 5.
30. The article of claim 29 wherein the volume percent of dispersed particles is from about 0.5 to about 2.
31. The article of claim 30 wherein the particle size is in the range of from about 10 to about 500 nanometers.
32. The article of claim 31 wherein the aluminide diffusion coating material selected from the group consisting of platinum aluminides and simple aluminides and wherein the overlay alloy coating material selected from the group consisting of MCrAlX wherein M is iron, cobalt, nickel, or alloys thereof and wherein X is hafnium, zirconium, yttrium, tantalum, platinum, palladium, rhenium, silicon or a combination thereof.
33. The article of claim 32 wherein the bond coat layer comprises an aluminide diffusion coating material and has a thickness of from about 0.5 to about 4 mils.